

# SC2002 OBJECT-ORIENTED DESIGN & PROGRAMMING CAMP APPLICATION AND MANAGEMENT SYSTEM

# Report of Project Structure Design & Functionality

# **AY2023/24 Sem 1, SCMC, Group 5**

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GitHub Main Page: https://github.com/dysfunkt/SC2002 Assignment CAMs

# Declaration of Original Work for SC/CE/CZ2002 Assignment

We hereby declare that the attached group assignment has been researched, undertaken, completed, and submitted as a collective effort by the group members listed below.

We have honoured the principles of academic integrity and have upheld Student Code of Academic Conduct in the completion of this work.

We understand that if plagiarism is found in the assignment, then lower marks or no marks will be awarded for the assessed work. In addition, disciplinary actions may be taken.

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# 1 APPLICATION OVERVIEW

Camp Application and Management System (CAMs) is a Java console application designed for staff and students to manage, view and register for camps within NTU. The application acts as a centralised hub for all staff and students.

# 2 ASSUMPTIONS MADE

We made some assumptions in our application to facilitate a smoother flow. Firstly, we assume that deleting an object completely removes it from our database, to maintain security of the system. Secondly, we assume that *Staff* can create multiple camps. Thirdly, we assume that users remember their user ID and password, as our CAMs would be synced to NTU systems similar to LDAP Login.

# **3 DESIGN APPROACH**

CAMs was designed with the aim of providing extensibility, maintainability and reusability, through the use of various SOLID and Object-Oriented Programming principles, to ensure our software design is efficient and understandable. We also aim to make the application as user-friendly as possible.

# 3.1 SOLID Principles

# 3.1.1 Single Responsibility Principle (SRP)

The Single Responsibility Principle (SRP) states that each class should have a clear, singular responsibility of its own - each class should be responsible for its own methods.

For example, we have implemented a few classes within our application to deal with specific functions. Our *Boundary* class deals solely with printing outputs and user interaction. Our *Controller* class deals solely with input storage. Our *Model* class is where objects are created from.

## 3.1.2 Open/Closed Principle (OCP)

The Open/Closed Principle (OCP) states that classes should be open for extension but closed for modification. For example, we created an abstract class *Repository*<*Model*>, which can be extended into different kinds of Repositories such as *CampRepository* or *EnquiryRepository*. *Repository* includes file I/O methods, which are usable by all its subclasses. Should we want to create a repository for a new *Model* item, we can easily extend from the base *Repository* class without modifying the original *Repository* implementation.

#### 3.1.3 Liskov Substitution Principle (LSP)

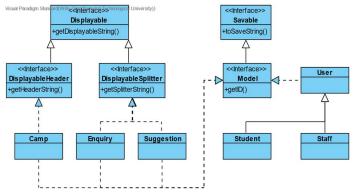
The Liskov Substitution Principle (LSP) states that subclasses must be substitutable for their base class. If class A is a subclass of class B, we should be able to replace B with A without disrupting program behaviour. For example, the team has implemented the *BaseUI* class, with many menu UI classes inheriting from the *BaseUI* class. The inherited classes behave as expected of the *BaseUI* – to ensure the menu flow of each function of the CAMs is run smoothly, containing its own ability, no more and no less.

## 3.1.4 Interface Segregation Principle (ISP)

The Interface Segregation Principle (ISP) states that having many specific interfaces is better than having one

general interface.

For example, in our application, we have created the *Displayable* interface class. This allowed us to extend *DisplayerHeader* and *DisplayerSplitter*, each with their unique methods. *Displayable* interface defines *getDisplayableString()*, which allows objects to be displayed.



# 3.1.5 Dependency Injection Principle (DIP)

The Dependency Injection Principle (DIP) states that high-level modules should not depend on low-level modules, but instead they should both depend on abstractions.

For example, *Displayable* also serves to fulfil DIP, as we now depend on *Displayable* interface, which is less likely to be changed. We can create more subclasses extending from *Displayable* with the least effort needed in the future, making our application more extendable.

## 3.2 OBJECT-ORIENTED PRINCIPLES

#### 3.2.1 Inheritance

Inheritance is a concept that allows subclasses to inherit attributes and functions from its superclass. This concept is prominent in our application, as many of our classes are derived from a base class, namely our *BaseUI* superclass which created all our UI Classes within the *Boundary* Class.

### 3.2.2 Encapsulation

Encapsulation is a concept where certain class attributes are only accessible through their accessor and mutator methods. This is to ensure their visibility is set to private/protected and hidden from other classes, or only be visible to subclasses or classes within the same package. Our *Model* classes demonstrate this by keeping its attributes private but providing accessor and mutator methods to modify it.

## 1.2.3 Polymorphism

Polymorphism is a concept that refers to the ability of a function, or object to take on multiple forms, based on the type of data being used in the method or class. We use "Method Overloading", a concept of Polymorphism. For example, our *CampManager* class provides different ways to call the method *getListByFilter()*, which prints out a list of camps based on user choice. If the user wants to filter by Date, or Camp Location, he is thus able to. We also use "Method Overriding" to override the *generateMenuScreen()* function, so that each UI class will print a different menu when its *generateMenuScreen()* function is called.

# 3.4 FURTHER CONSIDERATIONS

These are some further improvements we made to our application beyond the given specifications. Firstly, users logging in for the first time are prompted to change their password. We made it so they are required to **create a strong password**: including uppercase, lowercase and numbers. This greatly enhances security of individual users in CAMS. Secondly, we implemented several **input validation features** in our application. Should users key in any value beyond the specified value, or a string instead of an integer, our error-checking will prompt the user again for a valid input.

Lastly, we strived to make our application **more user-friendly**. We split up the functions of the user into several menus, each serving its own purpose. This ensures that the user is not overwhelmed with a long list of options. Every time the user accesses a function that requires them to input a camp ID, we will display all available camps and their corresponding camp IDs, followed by allowing the user to input a camp ID by referring to that list. We ensure that the user does not have to scroll back up through our interface, or rely on their memory on which camp and camp ID they registered for, thus increasing ease of use.

# **4 REFLECTION**

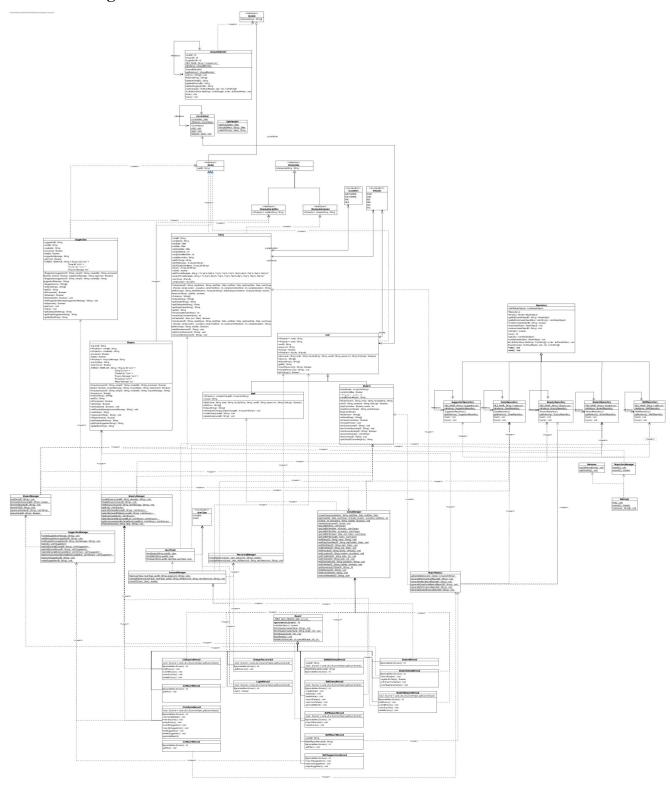
We reflected on some **possible improvements to CAMS** that we can implement in the future. Firstly, students who are unable to join a camp are put on a waitlist for that camp. If a registered attendee withdraws, the next person on the waitlist is automatically enrolled. This would ensure a fair, first-come-first-served policy instead of the student needing to constantly check on whether his preferred camp has an available slot. Secondly, we can notify students when their enquiries have been replied to. This can be in the form of a notification in the menu when the student logs in. Similarly, we can also notify camp committee members when new enquiries come in and staff when new suggestions come in. These changes make it more user-friendly.

Through this assignment, our team learnt a lot about the **importance of design principles** and how to apply them in real-world applications. At the start, we were unfamiliar with OOP design principles, and did not utilise much of it. We soon realised that modifying a class slightly would result in us having to change many other classes. Additionally, our classes became unbearably long and difficult to read. We decided to rebuild many of our classes from the ground up and by adhering to the SOLID principles closely, we managed to reduce the coupling amongst classes to make our program **flexible**, **easily maintainable**, **and extendable**.

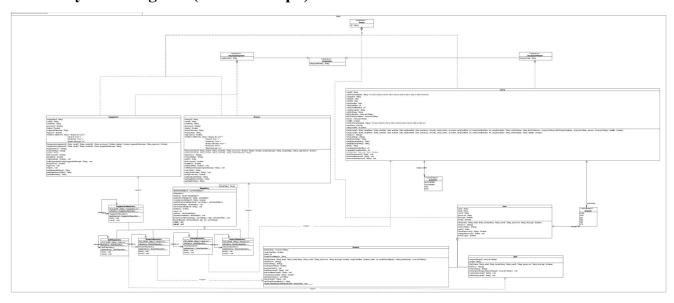
This assignment is the first time for many of us that we are working on a large scale application as a group. As such, we have taken this opportunity to learn Git and Github. This made the process of synchronising progress a lot easier. This skill is timeless and will remain valuable/useful for the foreseeable future.

# **5 UML DIAGRAM**

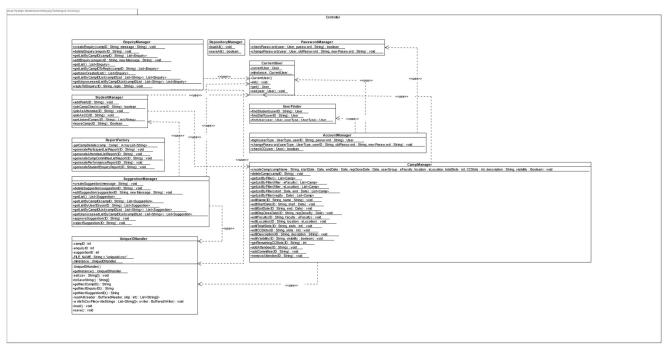
# 5.1 Main Diagram



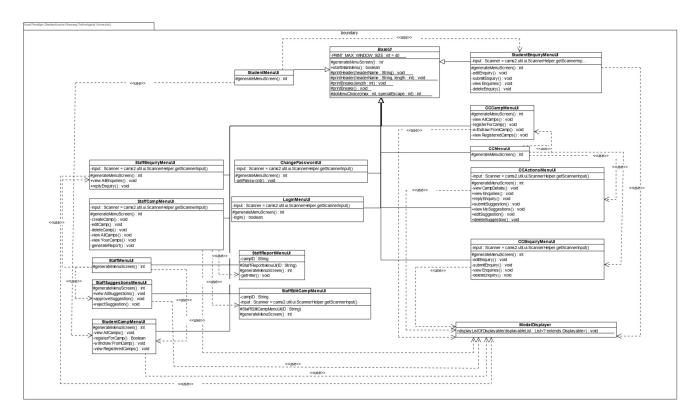
# 5.2 Entity Sub Diagram (Model + Repo)



# 2.3 Controller Sub Diagram (by itself)



# 2.4 Boundary Sub Diagram (all the UI)



# 3. TEST CASES

# 3.1 WELCOME PAGE

# 3.1.1 Login Page

The User is able to view the Login Login Menu page of our system. Login
 Exit Application Enter menu option: 1 They can proceed to login and choose 1) Staff 2) Student whether to login as Staff or Student. Select your domain (1-2): 2 Enter Username: test Enter Username: KOH1 We use Student KOH1 as an example. We check for valid Username and Enter Password: test Enter Password: test Password. Username not found. Incorrect Password. Enter Username: KOH1 Enter Password: password Upon successful first time login, we Change Password prompt the user to change password. Password must be at least 8 characters long.
Password must have at least one uppercase character, one lowercase character and one digit.
Enter old password: password
Enter new password: Password1
Password changed successfully!

#### 3.1.2 Change Password

The Student can still change his Student Main Menu password again inside the app. 1) Go To Camp Menu 2) Go To Enquiry Menu 3) Change Password
4) Log out 0) Exit Application Enter menu option: 3 The user's new password must have an Change Password uppercase, lowercase and a number. Password must be at least 8 characters long. Password must have at least one uppercase character, one lowercase character and one digit. Otherwise, we will keep prompting. Enter old password: Password1 Enter new password: abcde Password must be at least 8 characters long. Enter new password: abcdefghij
Password must have at least one uppercase character, one lowercase character and one digit Password changed successfully if Enter new password: Password2 Password changed successfully! conditions are met.

#### **3.1.3 Log Out**

Once done, the user can log out. They Student Main Menu can then terminate the application. 1) Go To Camp Menu Login Menu 2) Go To Enquiry Menu 3) Change Password 4) Log out 0) Exit Application 1) Login 0) Exit Application Changes are saved and the application Enter menu option: 4 Enter menu option: 0 You have successfully logged out. Closing application. shuts down.

# 3.2 STUDENT REGISTER AND WITHDRAW

#### 3.2.1 Student view available camps

Student can first view what camps he can register for. We use Student
KOH1, Password1 as an example again.

Student can filter by View All, or other options like Location.

Student can first view what camps he can register for. We use Student
Student Camps Menu View Camps

| 1) View Camps | 1) View All | 2) Faculty | 3) Location | 4) View Registered Camp | 3) Location | 4) View Registered Camp | 3) Location | 4) Camp Dates | 5) Return to Student Menu | 5) Registration Date | 6) Cancel | 60 Can

## 3.2.2 Student register for a camp as either an attendee, or committee

When registering, the list of available camps is printed again for reference.

Student can choose whether to register as an Attendee or Committee. Input must be 1 or 2 or it will keep prompting.

Enter menu option: 2

Register for Camp

| Start Date | Reg. Close Date | Reg. Close Date | Reg. Close Date | Paculty | Location | Att. slots left | Description | Camp for Arts |

Enter ID of camp to register (Enter 0 to cancel): 1

Register as Attendee (1) or Camp Committee (2): 3

Invalid Plus. Please ensure you enter a number less than 3

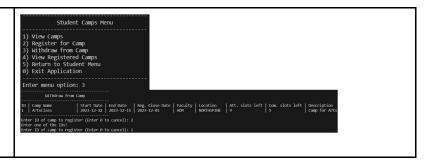
Register as Attendee (1) or Camp Committee (2): 1

Joined camp as Attendee successfully!

#### 3.2.3 Student withdraws from camp

Student can withdraw from camp if he changes his mind.

We make sure that the Student is ONLY withdrawing from a camp he is registered for. If successful, he withdraws. If not, prompt again.



# 3.3 CAMP COMMITTEE SUBMIT ENQUIRY AND SUGGESTION

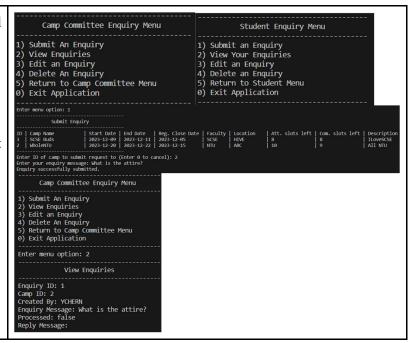
## 3.3.1 Camp committee submit an enquiry

Committee Enquiry/Camp Menu has all the same functions that Student has. We login again as *Student* YCHERN, password Password1 to demonstrate this.

A *Camp Committee* is able to submit enquiries for any camp he can view, just like a *Student*.

After submitting an enquiry, he can view it again, edit it, or delete it.

He can check to see if a *Staff/Committee* has replied to his enquiry.



# 3.3.2 Camp committee view camps he is committeeing for

A *Student* who chose to register as a *Camp Committee* (see 3.2.2) has a NEW menu to choose from. (Option 3)

*Committee* is able to view camps he is committeeing for.

```
Camp Committee Main Menu

1) Go To Camp Menu
2) Go To Enquiry Menu
3) Go To Committee Actions Menu
4) Change Password
5) Log Out
6) Exit Application
Enter menu option: 3

Camp Committee Actions Menu
1) View Registered Camp Details
2) View Enquiries
3) Regily To Me Enquiry
4) Polyow Enquiries
3) Regily To Me Enquiry
4) Polyow Enquiries
5) Regily To Me Enquiry
6) Polyow My Suggestion
9) Exit Application
1) Enter menu option: 1

Camp Details
1D Camp Name | Start Date | End Date | Reg. Close Date | Faculty | Location | Att. slots left | Description |
1D Camp Name | Start Date | End Date | Reg. Close Date | Faculty | Location | Att. slots left | Description |
2D Camp Name | Start Date | End Date | Reg. Close Date | Faculty | Location | Att. slots left | Description |
2D Camp Name | Start Date | End Date | Reg. Close Date | Faculty | Location | Att. slots left | Description |
2D Camp Name | Start Date | End Date | Reg. Close Date | Att. Slots left | Description |
2D Camp Name | Start Date | End Date | Reg. Close Date | Att. Slots left | Description |
2D Camp Name | Start Date | End Date | Reg. Close Date | Att. Slots left | Description |
2D Camp Name | Start Date | Reg. Close Date | Att. Slots | Att. Slots left | Description |
3D Camp Name | Start Date | Reg. Close Date | Att. Slots | Att. Slots | Reg. Close Date | Att. Slots |
```

## 3.3.3 Camp committee submit suggestion for his camp

Committee is able to submit suggestions for his camp.

| View Registered Camp Details | 2) View Requires | 3) Repty On An Enquiry | 4) Submit a Suggestion | 5) View My Suggestions | 6) Edit a Suggestion | 6) View My Suggestions | 6) Edit a Suggestion | 7) Delete a Suggestion | 6) Edit a Suggestion | 7) Delete a Suggestion | 8) Return to camp Committee Menu | 6) Exit Application | Enquiry ID: 1 | Enter menu option: 4 | Camp ID: 2 | Created By: YCHERN | Enter your Suggestion more water coolers | Suggestion submitted successfully!

## 3.3.4 Camp committee view and reply enquiries

Committee is able to view all enquiries from students for his camp, and reply to them.



#### 3.3.5 Camp committee cannot quit camp

Committee is not allowed to withdraw from a camp they are committeeing for. Unsuccessful withdrawal.



## 3.4 STAFF GENERATE CAMP REPORTS

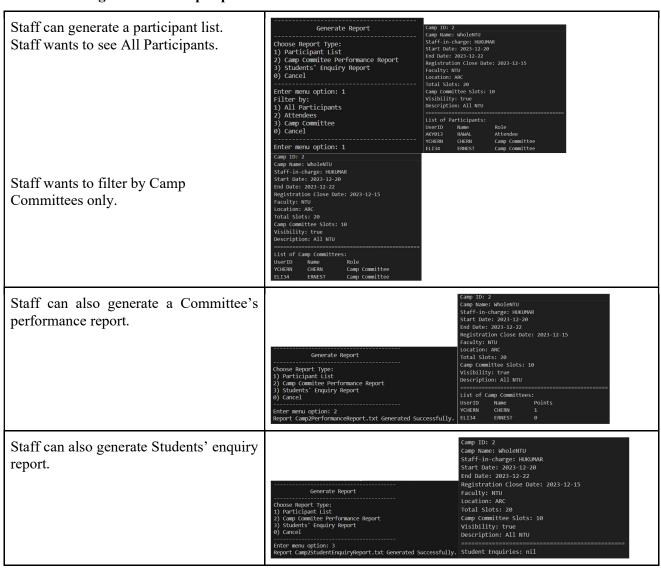
#### 3.4.1 Staff view all camps

Enter menu option: 1 Now we use Staff HUKUMAR. Staff Main Menu Staff Camps Menu Password1. Staff are able to view ALL 1) Create Camp 2) Edit Camp 3) Delete Camp 4) View Camps 1) Go to Camp Menu camps, even those set to not visible. 2) Go to Enquiry Menu
3) Go to Suggestions Menu
4) Change Password
5) Log out
0) Exit Application 5) View Your Camps 6) Generate Camp Report 7) Return to Staff Menu 0) Exit Application Enter menu option: 4 View Camps Filter by: 1) View All 2) Faculty 3) Location 4) Camp Dates Registration Date

## 3.4.2 Staff view their own camps



# 3.4.3 Staff can generate a camp report



#### 3.5 STAFF CREATE AND EDIT CAMPS

## 3.5.1 Staff inputting camp details

Staff are able to create new camps. From Staff Camps Menu the Staff Camp Menu, we can choose to Create Camp Edit Camp create a new camp. Delete Camp View Camps View Your Camps Generate Camp Report Return to Staff Menu Exit Application Enter menu option: 1 Staff can create camps by inputting the date (yyyy-MM-DD) that the camp starts: 2023-12-20 the date (yyyy-MM-DD) that the camp ends: 2023-12-22 the date (yyyy-MM-DD) that the registration ends: 2023-12-12 oup camp is open to (1 for your faculty, 2 for whole NTU): 2 Camp Location: Choose location of camp: camp details into the system. c CHOICE: 3
total # of slots for students: 20
total # of slots for camp committee (Max 10): 11
id Input. Please ensure you enter a number less that
total # of slots for camp committee (Max 10): 10
camp Description: All You camp visible? [Y]es/[N]o: Y We do error-checking to make sure we can only have 10 camp committees. Camp has been created successfully.

## 3.5.2 Staff editing camp details

Before editing, we print a list of camps that the Staff can edit. Staff cannot edit camps he has not created.

| Camp Edit Menu | Choose detail to edit: | 1) Camp Name: | 2) Camp Name: | 2)

#### 3.5.3 Staff delete camp

When the delete-camp function is called, it shows a list of delete-able camps.

In case Staff changes his mind, he can choose N to cancel the delete.

If not, he can choose Y and delete the camp.

Camp has been deleted successfully.

Staff caps Nevu

Staff caps